

STUDIES IN THE GENUS *CASSIA* IN SOUTH AFRICA: 2. NOTES ON *CASSIA ITALICA* (MILL.) LAM. EX F. W. ANDR.

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ABSTRACT

Two characters (stigma form and ovary indumentum) previously unused in subspecific delimitation within *Cassia italica* (Mill.) Lam. ex F. W. Andr. are considered and additions are made to features already useful in infraspecific classification in this taxon. Two subspecies, the one comprising three forms, are confirmed for the species in southern Africa and distributional ranges for the taxa are given. Some previously perplexing variants are clarified.

UITTREKSEL

'N STUDIE VAN DIE GENUS *CASSIA* IN SUID-AFRIKA:

2. AANTEKENINGE OOR *CASSIA ITALICA* (MILL.) LAM. EX F. W. ANDR.

Twee kenmerke (stempelvorm en ovariumbehaaring) wat voorheen nie in die afbakening op subspecies-vlak in *Cassia italica* (Mill.) Lam. ex F. W. Andr. gebruik is nie, word in oorweging geneem en word tot kenmerke wat alreeds nuttig is in die indeling op infraspecies-vlak in hierdie takson gevoeg. Twee subspecies, een bestaande uit drie forms, word bevestig vir die species in suidelike Afrika en die verspreidings vir die taksons word aangegee. 'n Paar variante waaroor daar voorheen onduidelikheid was, word toegelig.

Brenan (1958) outlined the wide geographical range of *Cassia italica* (Mill.) Lam. ex F. W. Andr. and analysed its "... remarkable range of variation, ...". On leaf, inflorescence and flower characters, this author was able to recognize three races which he appropriately designated subspecies because of their mostly distinct distributions and because of occasional inconsistencies in the correlated characters by which they were distinguished. Table 1 gives a summary of these distinctions and of the geographical ranges of the subspecies as determined by this author. The southern race, subsp. *arachoides*, is undoubtedly the most variable. Much South African material corresponds with the holotype of this subspecies (South Africa, Griqualand West, *Burchell 1680*, K), but Brenan (1958) enumerated three variants that diverge from this type and he listed other "... perplexing specimens ...".

In revising *Cassia* for the *Flora of Southern Africa*, it became necessary to take up the study of this subspecies and of subsp. *micrantha*, both of which reach the Flora area, and to pursue the "perplexities" that Brenan had so ably exposed.

This subsequent study has revealed the presence within *C. italica* of two characters convenient in infraspecific diagnosis that were unused by Brenan.

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These are:

1. *Stigmatic form*

In subsp. *arachoides* the style is long and more or less coiled: it terminates in a stigmatic zone only slightly wider than the style breadth which narrows again to end in a small more or less circular opening (Fig. 1a, b; Fig. 2b, c).

In subsp. *micrantha* the style is visibly shorter and does not coil, but merely recurves towards the ovary: the terminal stigmatic zone is clearly wider than the style and asymmetrically trumpet shaped (better developed adaxially than abaxially) with an opening as wide as the stigmatic expansion. In herbarium specimens the delicate margin of this stigmatic tissue is usually reflexed, but this is not often the case in living flowers (Fig. 1c; Fig. 2a).

In the few specimens of subsp. *italica* I have examined, the stylar and stigmatic form agreed precisely with that of subspecies *arachoides*. Probably this could do with further checking.

Because style and stigma persist after pollination and can be seen clearly exposed on young developing fruits, the form of these structures provides a useful means by which to distinguish the subspecies *micrantha* and *arachoides*. The criterion seems reliable (as is to be expected considering the use that has been made of stigmatic form in aiding the delimitation of genera in papilionates, for example *Dolichos* and its allies, Verdcourt, 1970), for among the more than 200 specimens examined, only one possible intermediate was encountered (see *De*

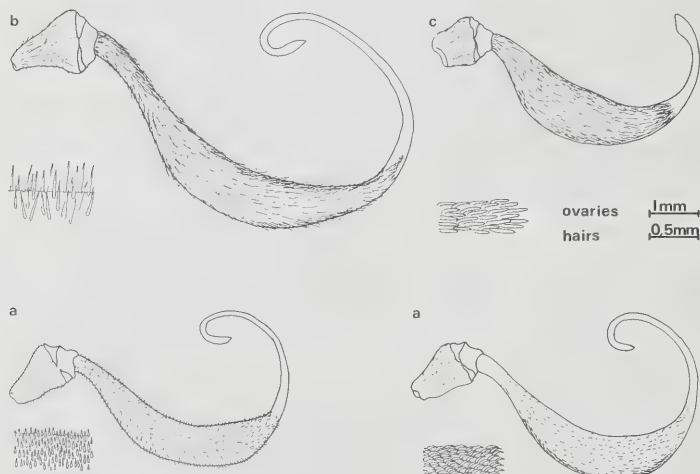


FIG. 1.

CASSIA ITALICA, developing ovaries with their indumentum types; a. subsp. *arachoides* minute-haired form with trichomes patent (left) and curved (right); b. subsp. *arachoides* villous form; c. subsp. *micrantha*.

Winter & Leistner 5756 later) but this had clearly the stigmatic structure of subsp. *micrantha*.

2. Indumentum of developing ovary and mature legume

Vesture, together with some consideration of the hair types comprising it, has been used before in infraspecific classification within *C. italica*. Burt Davy (1932) established *C. obovata* var. *pilosa* for plants with stems, rachises and leaves pilose, while Brenan (1958) included indumentum among the characters he used (see Table 1). No author yet seems to have commented upon the indumentum of, or its absence from, young ovaries or mature fruits. This may be because the trichome types present are those of the vegetative organs, but on the ovaries in particular, the hairs are closely packed and thus readily observed, especially as the outer floral parts fall away after fertilization to leave the young ovaries exposed. This character aids particularly in the recognition of variants within subsp. *arachoides*, but can be used as an additional means by which to distinguish the two subspecies.

In the subspecies *micrantha* ovaries are densely clothed in curved, appressed, white hairs which give them an almost hoary appearance (Figs 1c: 2f). Occasionally some of these hairs are swollen and inversely bottle-shaped (perhaps serving as water reservoirs?). As growth and maturation of the fruit takes place, the hairs become spaced so that the mature valves are sparsely appressed-pubescent.

In subsp. *arachoides* the indumentum is not uniform and four variants or forms may be recognized:

Variant	Ovary	Legume	Trichome type (representative of whole plant)
A (typical form)	glabrous	glabrous	short, straight, patent, scattered (Fig. 3a, g)
B (minute-haired form)	densely appressed- pubescent	sparsely appressed- pubescent	minute, curved appressed (Figs. 1a, right; 2d; 3d)
C (minute-haired form)	densely pubescent	sparsely pubescent	minute, straight, patent (Figs. 1a, left; 2e; 3f)
D (villous form)	densely villous	villous	long, slender, straight, patent, fine hairs (Figs. 1b; 2g; 3h)

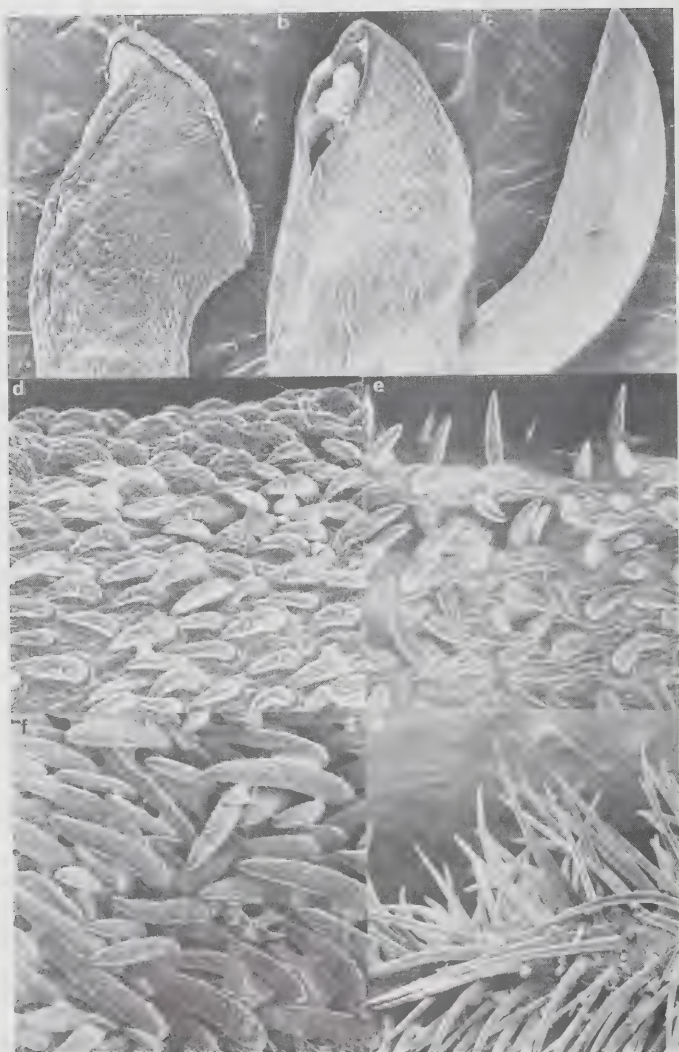


FIG. 2.

CASSIA ITALICA, scanning electron micrographs of: a. subsp. *micrantha*, stigma (X 105); b. & c. subsp. *arachoides*, stigma (X 105); d. subsp. *arachoides* minute-haired form (trichomes curved), ovary indumentum (X 300); e. ditto but trichomes patent (X 300); f. subsp. *micrantha*, ovary indumentum (X 300); g. subsp. *arachoides* villous form, ovary indumentum (X 135).

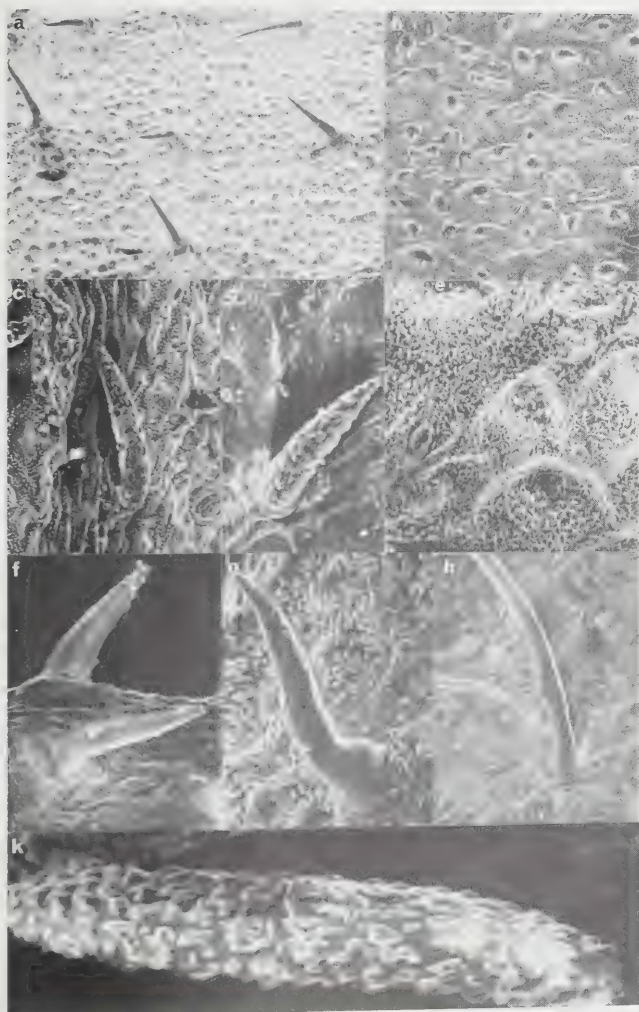


FIG. 3.

CASSIA ITALICA, scanning electron micrographs of: a. subsp. *arachoides* typical form, leaf surface showing trichomes and papillae (X 125); b. ditto, papillae enlarged (X 200); e. ditto, further enlarged, note stoma (X 800); g. ditto, single trichome enlarged (X 600); c. subsp. *micrantha*, leaf surface showing single trichome (X 600); k. ditto, further enlarged (X 1625); d. subsp. *arachoides* minute-haired form, leaf surface showing single curved trichome (X 600); f. ditto showing two patent trichomes (X 600); h. subsp. *arachoides* villous form, leaf surface showing base of trichome and several stomata (X 300).

On the basis of stigma type and indumentum it has been possible to clarify one of the doubts expressed by Brenan, 1958, and to provide a few more facts relevant to the understanding of infraspecific variation in *C. italica*.

Burt Davy 7040 (K) from hotel-yard at Pienaars River Station, Transvaal, that was doubtfully determined by Brenan l.c. as subsp. *micrantha*, has been re-examined by Dr J. H. Ross, SA Liaison Officer at Kew, whom I should like to thank. This specimen has the stylar form typical of subsp. *arachoides*. It is therefore in accord with distributional patterns of variants within *C. italica* determined in the present study, for no specimens of subsp. *micrantha* have been found further east than *Lugard 201* from Kwebe Hills, Botswana, approximately S 20° 40'; E 23° 5' (also cited by Brenan, 1958).

The only other specimen seen that did not immediately fall within one or other subspecies on the basis of the two characters mentioned above was *De Winter & Leistner 5756* from Otjinungwa, north western South West Africa. This has the stylar form of subsp. *micrantha* but the indumentum of subsp. *arachoides*, to which taxon it was referred by Schreiber, 1967. (I prefer to place it with subsp. *micrantha* as, in my opinion, it also agrees with this taxon in petiole length, inflorescence/leaf ratio and leaflet apex). It is from an area where both these subspecies are thought to be sympatric (but this must be checked on the ground, if possible). Such a specimen suggests that outbreeding is possible between these subspecies, as would be expected.

From study of the indumentum of ovary and fruit in the considerable amount of material of subsp. *arachoides* available in herbaria, it has been possible to gain better knowledge of, and roughly to delimit the areas occupied by, the variants within this subspecies, some of which were listed by Brenan 1958: 243.

Variant A represents the typical form of subsp. *arachoides*. Here ovary and fruit are glabrous. Plants are sometimes described as glabrous and glaucous. The latter epithet is well applied, but strictly plants are not glabrous for magnification reveals scattered *short* straight patent hairs on leaves and stems that Brenan referred to as "Indumentum saepius breve, sparsum, patens . . ." (Fig. 3a). Often on young stem apices in particular, and especially in plants growing where environments are extreme, the hairs are interspersed with small, short-stalked or subsessile elliptical glands that impart a certain viscosity. The leaves are also often papillate as is clearly revealed by electron scanning (Fig. 3a, b, e). This typical form is the "dryland" variant within subsp. *arachoides*, for plants occupy harsh, sub-desertic environments in South West Africa, Botswana, the northern central Cape Province, the Orange Free State and the western Transvaal (Fig. 4). A majority of southern African plants belong with this form.

Variants B and C represent Brenan's variant (2). These plants are green, not glaucous, and again appear glabrous to the naked eye, but microscopic examination reveals minute hairs more closely packed than in the typical form. Ovaries and fruits are hairy, not glabrous. In some plants (variant B) the hairs are curved

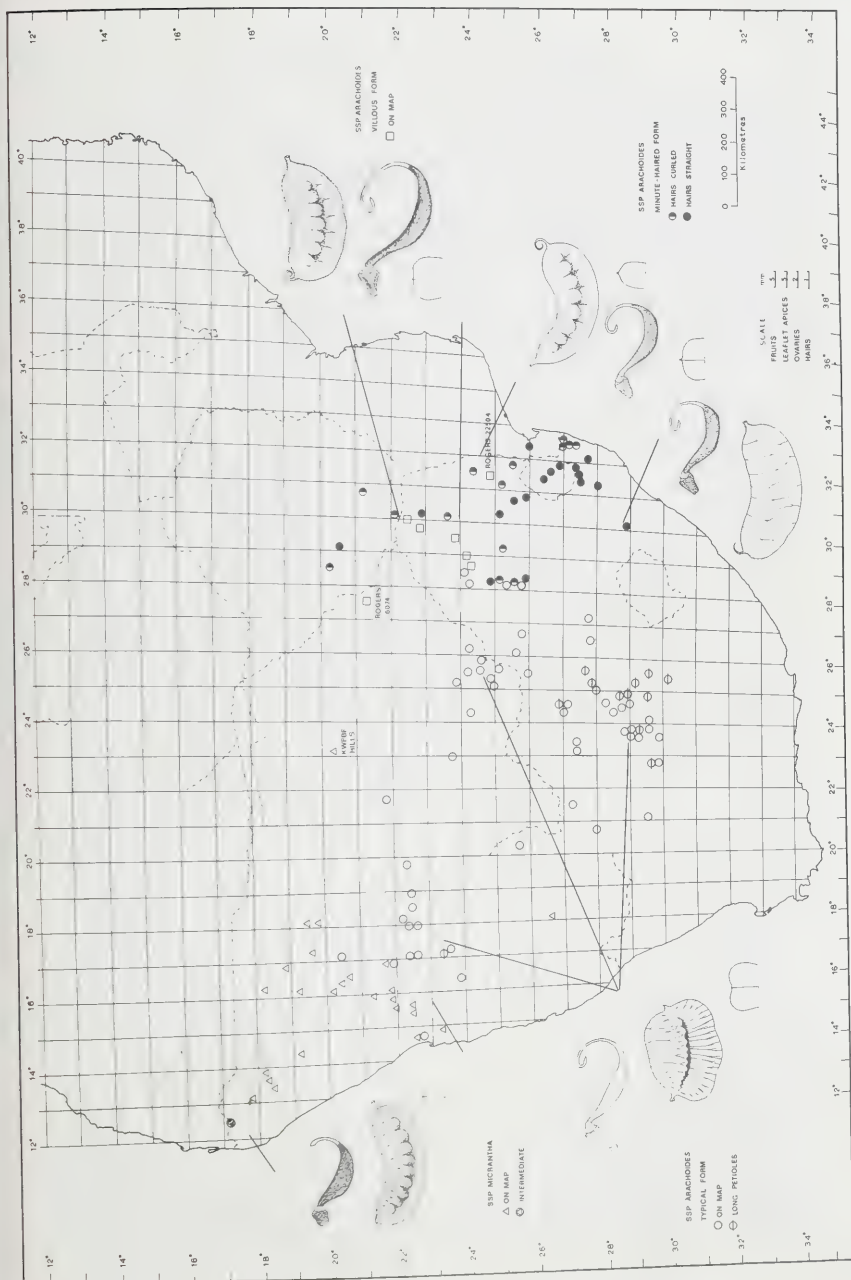


FIG. 4.

CASSIA ITALICA, distribution of subspp. and forms in southern Africa. Marginal illustrations show quary, fruit and leaflet apex for each subspp. and form.

and appressed; in other plants (variant C) the hairs are straight and patent. Brennan did not differentiate between the two hair types, so it is uncertain whether he noticed them or not. Of the specimens he cites I have not seen *Trapnell 744* from Natal, but *Barnard & Mogg 966* and *Codd & De Winter 5009*, both from the Transvaal, have curved hairs. Natal and Swaziland plants more commonly have straight, patent hairs, while those from the Transvaal are often curved, but this is not absolute.

These minute hairs, be they curved or straight, are distinguishable *under magnification* ($\pm \times 20$) from the hairs of subsp. *micrantha* and from hairs of the typical form of subsp. *arachoides*. Especially on the ovaries is this the case, for the longer appressed hairs of subsp. *micrantha* overlap to a degree that the minute hairs do not (compare Fig. 2d, e, f). This minute-haired form is the "moist-land" variant within subsp. *arachoides*. This appellation is, nevertheless, something of a misnomer, for plants, like those of the typical form, also occur in open, dry habitats, but such conditions in eastern Southern Africa are far less harsh than are the sub-desertic conditions of the west. The minute-haired form occurs in Rhodesia, Moçambique, Swaziland, the Transvaal and Natal as far south as the Tugela Valley. In the Transvaal it is mainly central and eastern: towards the west there is overlap with the typical form.

Variant D represents Brennan's (1958: 242) variant (1) and, as this author stated, is also probably the form that Burt Davy (1932: 325, Type: *Rogers 22504*, Transvaal, Pilgrims Rest distr., Newington—not seen by me) established as *C. obovata* var. *pilosa* (non *Senna obovata* (Collad.) Batka var. *pilosa* Batka which is *Cassia italica* subsp. *italica*). Also probably belonging here is *Moss & Rogers 36*, which Baker (1930) and following him Burt Davy (1932) tentatively placed with *C. holosericea* Fresen., which is a north-east African species with villous pubescence resembling that of Variant D, but with smaller flowers and pods that lack a line of crests.

Variant D is the villous form within subsp. *arachoides*. The hairs to the ovary, mature legume, peduncle and the vegetative organs are long, fine, straight, patent and closely packed so that the indumentum is villous. Brennan cited only three specimens of this form, but the present survey has shown that it is well established in the Transvaal north of S 25° and between E 28°–30° 30'. *Rogers 6074* from Francistown, Botswana is not quite as evidently hairy to the naked eye as are most specimens referred to this form. If this gathering and *Rogers 22504* are included in variant D, then its distributional limits are extended slightly east and west.

Other characters correlated with variation within C. italica

3. *Leaflet apex*

Burt-Davy (1932: 325) established *C. obovata* var. *mucronata* (Type: *Galpin 750*, Transvaal, Barberton, near Queen's River) for plants in which the leaflets are drawn out into a mucron 0.5 to 1.0 mm long. It is not necessary to maintain this

taxon, for this character appears to be correlated with the development of minute hairs, so that it is a feature of the minute-haired form of subspecies *arachoides*. It is not limited to this entity, however, because plants of subsp. *micrantha* usually develop leaflets with similar mucronate apices. In contrast, the typical form of subsp. *arachoides* generally has emarginate leaflet apices. The only deviation from this is in occasional plants where whole leaves (and their leaflets) are very much larger than usual and are assumed to have developed during exceptionally favourable growth periods. The apices to these larger leaflets are rounded rather than emarginate, sometimes with a poorly-defined mucron. In the villous form of subsp. *arachoides* apices vary from more or less emarginate, to rounded, sometimes with a poorly-defined or short mucron.

4. Legume crests and legume shape

In *C. italica*, each valve of the legume develops a lengthwise midline of discrete, small evaginations called "crests". Burt-Davy (1932: 325) described *Galpin 750* (type of his var. *mucronata*) as bearing pods lacking crests, but on the several sheets of this gathering in various herbaria, some pods show some evidence of evaginations. Study has shown that it is rather exceptional to find all legumes developed by a plant without trace of crests but sometimes they are scarcely discernible as in the (straight) minute-haired form in Natal (*Ward 3613*, PRE, NH, NU). Small, poorly-defined crests are known only among plants from eastern southern Africa: thus this feature seems correlated with the minute-haired form, but it is by no means always developed here, however, and as Brenan (1958: 243) suggested, seems no more than a chance variation.

Legume shape also shows variation. This seems to correlate in part at least with the taxa already recognized within *C. italica*. Pods of plants of the typical form of subsp. *arachoides* are usually more or less sub-orbicular with glabrous valves on which the veins are clearly marked (Fig. 4), whereas pods of all other variants including subsp. *micrantha* develop longer, narrower, more or less oblong pods, in which the valves carry an indumentum and where the veins are usually less obvious (Fig. 4). It is tempting to think these differences in shape are the result of differences in rates of growth concomitant with the differing environments under which the plants grow, but this is not supported in the case of fruits of subsp. *micrantha*.

5. Petiole length

Reference to Table 1 shows that Brenan (1958) recognised subsp. *arachoides* as having shorter petioles than either of the other two subspecies. Thus he found perplexing certain specimens which, while agreeing with other characters of this taxon, yet possessed long petioles. Some of these specimens otherwise resembled the holotype of subsp. *arachoides*; others belonged with the minute-haired variant. In attempting an explanation for these long petioles, Brenan considered that they

might be produced on young actively growing shoots, or that they might result from introgression of subsp. *micrantha* into subsp. *arachoides*.

During the present study a number of points have become clear:

- (i) within the distributional range of the typical form of subsp. *arachoides* it is not unusual for short petioled leaves to be succeeded *on the same stem* by leaves with much longer petioles (*Werger 235*, Orange Free State, Hopetown distr. near Luckhoff, has leaves with petioles ranging roughly in sequence from 5.0–15 mm (Fig. 5)). Also in occasional localities, plants with petioles up to 19 mm long have been repeatedly collected. These localities mostly lie between S 26°–30° and E 23°–26° and include the Herbert district and Bloemhof from where, respectively, *Burchell 1764* and *Leistner 53* (both cited by *Brenan, 1958: 243*) were obtained. Other localities and specimens worth mentioning are: Vryburg, Armoedsvlakte, *Sharpe 7056*; Bloemhof, Kameelpan, Christiana, *Theron 427*; Prieska, *Bryant J178*. Then, too, in other dry areas such as South West Africa, a single gathering may be much more robust and larger in all its vegetative parts than other specimens from the same general locality (*Ihlenveldt 1888*, South West Africa, distr. Rehoboth, farm Bergland).
- (ii) Within the minute-haired form it is usual for leaves to have petioles longer than the range given by *Brenan (1958)* for subsp. *arachoides* (see Table 1). Apart from the specimens of this group cited by *Brenan* as "perplexing", there are many others that exhibit the same feature (*Edwards 3189*, Natal, Ngotshe distr., 1½ ml. from Pongola bridge on Magudu road, carries leaves with petioles from 10–18 mm long on the same plant).
- (iii) Considering the range in petiole length recorded for leaves on single stems, it seems probable that within the typical form of subsp. *arachoides* at least, this is a seasonal, or a habitat, phenomenon associated with favourable growing conditions. This is surely not unexpected considering the response that usually results from the presence of moisture in inhospitable environments. On the basis of present distributions it seems unlikely that introgression from subsp. *micrantha* is the explanation underlying these longer petioles since most specimens are known from near the south eastern distributional limit of the typical form. But what is the explanation underlying the presence of the villous form of subsp. *arachoides* in the Pietersburg area of the Transvaal and probably further north? Is this a case of introgression, but with a taxon not now represented there?

6. Relative lengths of leaves and inflorescences and flower size

Brenan, 1958, collectively used three characters to classify *C. italica* at infraspecific level. These were:

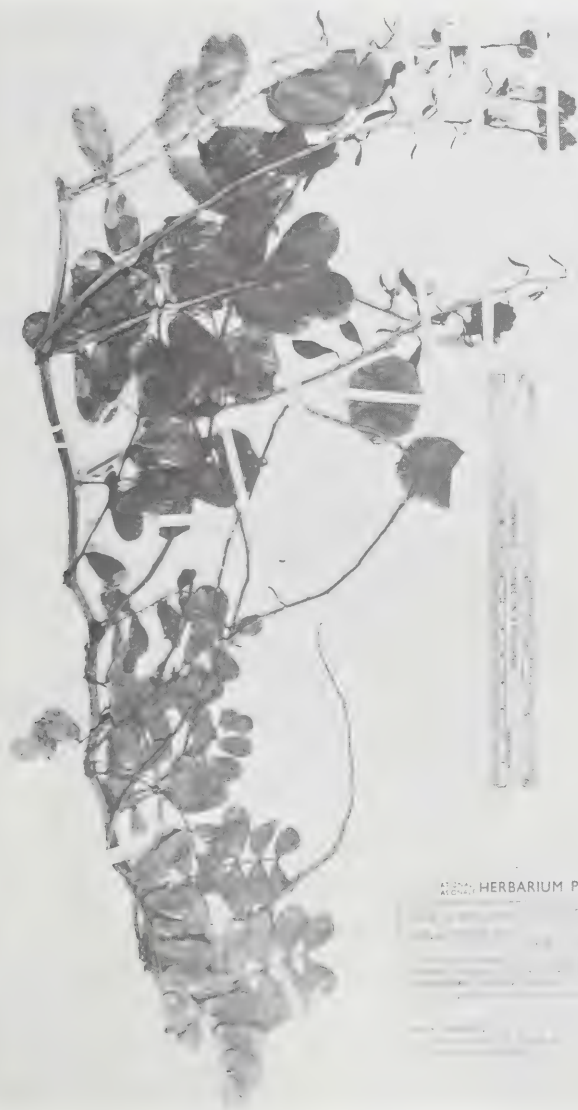


FIG. 5.

CASSIA ITALICA subsp. *arachoides* typical form: Werger 235 from near Luckhoff, stem showing variation in leaf and leaflet size.

TABLE 1.
Characters used by Brenan (1958) to differentiate subspecies within *C. italica*

	subsp. <i>italica</i>	subsp. <i>micrantha</i>	subsp. <i>arachoides</i>
petiole length	mostly 10–35 mm	mostly 10–25 mm	mostly 3–12 mm
raceme length	60–230 mm	20–80 mm	70–220 mm
raceme length: subtending leaf length	mostly raceme ex- ceeding subtending leaf, sometimes subequal	raceme shorter than subtending leaf	mostly raceme ex- ceeding subtending leaf
sepal length	8,0–13,0 mm	5,0–8,0 mm	8,0 mm
petal length	9,0–20,0 mm	8,5–9,0 mm	10,0–12,0 mm
petal width	5,0–10,0 mm	3,5–4,5 mm	5,0–6,0 mm
anther lengths			
longest	8,0–14,0 mm	5,5–6,0 mm	8,0 mm
medium	4,0–6,0 mm	2,5–3,5 mm	2,5–3,0 mm
shortest	1,5–2,5 mm	1,25 mm	1,0 mm
indumentum	appressed-puber- ulous, occasionally shortly spreading- pubescent	appressed- puberulous	often short, sparse, spreading, rarely dense, or appressed- puberulous
distribution	Cape Verde Is., Senegambia & Rio de Oro to Egypt & Somali- land & south to Nigeria, the Sudan & Ethiopia. Also Israel, Arabia, Persia, Baluchistan & n.w. India.	Ethiopia, British Somaliland, Uganda, Kenya, Tanzania, Botswana & South West Africa. Also most of India.	Rhodesia, Moçambique, South West Africa, Botswana, Swaziland & South Africa.

(a) ratio of subtending leaf length to inflorescence length

(b) petiole length

(c) flower size

He was careful to stipulate that none of these characters *considered separately* was absolute in enabling distinction to be made among the three subspecies, *italica*, *micrantha* and *arachoides*. The present work has shown that when these criteria are used (and they are helpful) the following additional attributes will make them easier to apply and more reliable in differentiation:

(i) inflorescence length for comparison against subtending leaf length: ideally measurement should take place as the first flower opens.

TABLE 2.

Main features useful in differentiating subspecies and forms within *Cassia italica* in southern Africa.

subspecies forms	<i>arachoides</i>	typical	<i>micrantha</i> minute-haired	villous
stigma	trumpet-shaped (Fig. 2a)	contracted into an aperture narrower than style (Fig. 2b, c)		
style	curved, $\pm$ 3-4 mm long (Fig. 1c)	more or less circinnate, 6-7 mm long (Fig. 1a, b)		
ovary indumentum	hoary	lacking	hoary	villous
ovary trichomes	see Fig. 1c; 2f	lacking	see Fig. 1a; 2d, e	see Fig. 1b; 2g
leaf trichomes	microscopic appressed	short, patent sparse (almost microscopic)	microscopic straight or curved	villous
petiole length in mm	9-23 (-25)	(3-)6-12(-19)	8-15(-20)	(3-)5-12
leaflet apex	mucronate	emarginate to rounded	mucronate	emarginate to rounded
petal length in mm	5-7(-9)	7,0-12,0	7,0-12,0	10,0-18,0
Pods	$\pm$ oblong trichomes short, appressed scattered	$\pm$ suborbicular glabrous, veins clearly marked	$\pm$ oblong trichomes minute, crests sometimes $\pm$ lacking	$\pm$ oblong villous
distribution	S.W. Africa; Botswana	S.W. Africa; Botswana; N. Cape; W. to central Transvaal	Swaziland; central & E. Transvaal; N. Natal & Tugela Basin	N. Transvaal; Botswana

(ii) petiole length and flower sizes: it is necessary to give a range for each attribute separately for each form or variant within this subspecies and not collectively for subsp. *arachoides*.

These additions are given in Table 2 which may serve as a summary for infraspecific variation within *C. italica* as this is presently known in South West

Africa, Swaziland and South Africa. A key permitting identification of the infraspecific taxa within *C. italica* represented in these countries is provided.

The following conclusions may be drawn:

1. No plants with *all* the size dimensions of subsp. *italica* have been seen from the area covered by the *Flora of Southern Africa*. There is no doubt, however, that the subsp. *italica* and *arachoides* are closely allied and differ quantitatively rather than qualitatively.
2. Subsp. *arachoides* is the most variable of the three subspecies and comprises three forms: the typical form (A) limited to the more arid parts of southern Africa, namely, S.W. Africa, Botswana, the western Transvaal and the north-western and northern Cape Province; the minute-haired form (B, C) represented in eastern southern Africa (the central and eastern Transvaal, Swaziland and Natal as far south as the Tugela river valley, also in Rhodesia, and Mocambique); the villous form (D) represented in the northern Transvaal (also probably in Rhodesia).

It has not been considered necessary to cite specimens additional to those listed by Brenan (1958).

It is interesting to postulate why subsp. *micrantha* should possess a stigma different from that of both other subspecies and why its distribution should be limited to India and central Africa and especially the latter where it breaks the distributional continuity of the stylar type representative of subsp. *italica* and *arachoides*. Can this be attributed to introgression by genetic material of a species of *Cassia* present in India and Central Africa, but absent elsewhere from the range of *C. italica*? *C. tora* in India and *C. obtusifolia* in Tropical Africa are closely related to one another and have a stigmatic form that might account for that of subsp. *micrantha*. All three taxa belong to the subgenus *Senna*, but to different sections of this subgenus. All have been recorded as possessing races with 14 chromosomes in the gametophytic phase (Irwin & Turner, 1960). Experimental breeding is required to test this postulate.

A duplicate of one of the syntypes of *C. obovata* Collad. var. *pallidiflora* Dinter in Feddes Repert. **15**: 355 (1918) (*Dinter 366*, Okahandja) is preserved at the South African Museum Herbarium (SAM). This specimen agrees with other specimens of subsp. *micrantha* from South West Africa cited by Brenan (1958) and thus Dinter's variety may now be accepted as falling within the limits of subsp. *micrantha*. Brenan (*l.c.*) stated that no syntypes of Dinter's variety were still in existence at Berlin and duplicates had been looked for in vain in the herbaria at Hamburg, the British Museum (Natural History) and Kew.

SCANNING ELECTRON MICROGRAPHS

The micrographs illustrating this paper were prepared in the following way: representative stigmas and pieces of ovaries and mature leaves removed from

herbarium specimens were mounted on stubs using double-sided adhesive tape. After drying for 24 hours in a desiccator, the specimens were coated in vacuum with gold-palladium to a thickness of less than 150 Å, then examined in a Hitachi SSM2 scanning electron microscope at a voltage of 10 kV. The images were observed at a magnification range 100– and photographed with a 35 mm camera.

KEY TO SUBSPECIES AND FORMS REPRESENTED IN SOUTHERN AFRICA

- Stigma (usually visible even on developing fruits) expanded to exceed the width of the style, asymmetrically trumpet-shaped (better developed adaxially than abaxially); style 3–4 mm long, curved but not $\pm$ circinnate; flowers pale yellow to cream, brown veined; racemes, when only basal flowers are open, 20–80 mm long, usually shorter than the subtending leaf subsp. **micrantha**
- Stigma (usually visible even on developing fruits) hardly expanded (subterminally only to slightly exceed style width) narrowing terminally to form an aperture usually narrower than the style; style 6–7 mm long, $\pm$ circinnate; flowers bright yellow, brown veined only with age; racemes, when only basal flowers are open, mostly 60–150 mm long, usually longer than the subtending leaf subsp. **arachnoides**
- Ovary glabrous typical form (A)
- Ovary bearing trichomes villous form (D)
- Trichomes long, fine $\pm$ straight, closely packed so as to form a villous pubescence villous form (D)
- Trichomes short (microscopic) rather thick for their length, straight or curved, closely packed when ovary very young minute-haired form (B & C)

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